DIVERSITY OF THRIPS FAUNA (INSECTA: THYSANOPTERA) IN PLUM ORCHARD FROM MORĂREŞTI-ARGES

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Abstract
The present study, conducted in the plums orchard of Morăreşti-Argeş at two plum varieties, has revealed a poor biodiversity. All of 10 species of thrips are polyphagous and belong to different trophic links: 8 species of phytophagous and 2 species, Aeolothrips intermedius and Haplothrips kurdjumovi are zoophagous. The structural parameters values indicate Haplothrips minutus as plum characteristic species, with the highest values of relative abundance and frequency in samples. However, this species has insignificant damaging in plum orchards. The low values of the structural indicators of the other species express their attachment to their characteristic trophic substratum, i.e. the herbaceous layer, so they only accidentally get on the plum branches, through anemochory. The Shannon-Weaver diversity index and equitability have low values, a situation which is typical of agro-ecosystems.

Key words: Haplothrips minutus, relative abundance, diversity index, plum variety

1. INTRODUCTION

Thrips are small insects, widespread throughout the world, with a preponderance of tropical species, but many temperate ones. Their habitats include forests, grasslands, scrub, desert, most cultivated crops and gardens. Of the 5500 or so known species only a few hundred are harmful and attack cultivated plants. The damage they cause is often slight but sometimes it can be severe and result in serious losses (Lewis, 1973).

In fruit orchards, a number of thrips species manifest their harming potential in keeping with the local, as well as the annual climatic conditions. Damage is often more severe in years when budbreak is delayed and prolonged which gives thrips more time to feed on tender tissue that is particularly susceptible to damage (Skinner and Parker, 1995).

The objectives of this research were to study diversity of thrips fauna in a hilly plum orchard and determine if thrips may manifest harming potential.

2. MATERIAL AND METHODS

The observations were carried out over the period 14 April - 11 May 2010 in a plum orchard from Morăreşti-Argeş, to Stanley and Anna Späth varieties. In this hilly region is cultivated the follow varieties of plum: Anna Späth, D'Agen, Tuleu gras, Stanley, Centenar, etc. and is not apply treatments against pests. Collecting the thrips from the crown of the plum trees was done by means of a square frame of a 60 cm side, covered with white cloth. In accordance with the phenophases of the plum, 10 samples were taken from each; a sample consisted of 50 shakes of the branches, which were chosen randomly. The phenophases were established in accordance with the scientific literature.

The thrips species was identified with the follow keys of determination: Knechtel (1951), Schliephacke & Koch (1980), zür Strassen (2003).

In order to assess the diversity of the ecosystem, the Shannon-Weaver diversity index was calculated, using the formula improved by LLOYD and GHELARDI:

$$H(S) = \frac{K}{N}(N\log 10N - \sum_{p=1}^{S} Nr \log 10 Nr) \quad \text{where:}$$

H = index; S = total number of species; K = 3. 321928; N = total number of individuals; Nr = total number of individuals in species r. (SIMIONESCU 1984).

3. RESULTS AND DISCUSSIONS

The numerical abundance reveals a total of 457 adults and 73 larvae of the two plums varieties, which belong only to 10 species (Table 1). All species are polyphagous, and most are primary consumers. Only two species belongs to the secondary consumers, the zoophagous *Aeolothrips intermedius* and *Haplothrips kurdjumovi.*

8 species are common to both plum varieties (Table 2).

Table 1. Thysanoptera species on „Stanley" and „Anna Späth" varieties, in Morăreşti- Argeş plums orchard

Suborder	Family	Subfamily	Species
Terebrantia	Aeolothripidae	Aeolothripinae	*Aeolothrips intermedius* Bagnall 1934
	Thripidae	Thripinae	*Limothrips denticornis* (Haliday 1836)
			Frankliniella intonsa (Trybom 1895)
			Thrips fuscipennis Haliday 1836
			Thrips tabaci Lindeman 1888
			Thrips vallidus Uzel 1895
			Taeniothrips inconsequens (Uzel 1895)
Tubulifera	Phlaeothripidae	Phlaeothripinae	*Haplothrips kurdjumovi* (Karny 1913)
			Haplothrips minutus (Uzel 1895)
			*Haplothrips subtilissimus (*Haliday 1852)

a. Structural indicators of thrips populations of Stanley variety

In our study, it was identified 9 thrips species: *Aeolothrips intermedius*, *Frankliniella intonsa, Taeniothrips inconsequens, Thrips fuscipennis, Thrips validus, Thrips tabaci, Haplothrips kurdjumovi, Haplothrips minutus, Haplothrips subtilissimus*.

Haplothrips minutus, Haplothrips subtilissimus and *Taeniothrips inconsequens* are arboricolous species. *Thrips fuscipennis* is known in the literature as present on the bark and leaves of different trees species. Other species as *Thrips validus*, *T. tabaci* and *F. intonsa* are polyphagous floricolous. Zoophagous species *Aeolothrips intermedius* and *Haplothrips kurdjumovi* are connected by trophic substrate with this ecosystem.

The analysis of dominance reveals *Haplothrips minutus* with the higher values of relative abundance: 53.3%. It is followed by *Thrips validus* species with 29.8%.

The highest values of structural parameters were recorded in „in bloom" and "falling of first petals" phenophases. Most species of this cenosis are incidental (Table 3.)

Vasiliu-Oromulu and Păişescu (1996) revealed only 6 species to Stanley variety in a plum orchard in Mărăcineni-Arges, intensively treated against pests. *Haplothrips minutus* species has the highest values of structural indicators, but below those recorded in this paper.

Table 2. Numerical and relative abundance of thrips species in plum orchard

Species	Stanley variety		Anna Spath variety		No. ind. (A)	Relative abundance (A%)
	A	(A%)	A	(A%)		
Aeolothrips intermedius	1	0,4	1	0,45	2	0,43
Limothrips denticornis	-	-	1	0,45	1	0,21
Frankliniella intonsa	10	4,2	10	4,5	20	4,37
Thrips fuscipennis	16	6,72	19	8,67	35	7,6

Thrips tabaci	3	1,26	4	1,82	7	1,53
Thrips validus	**71**	**29,8**	**66**	**30,1**	**137**	**30,0**
Taeniothrips inconsequens	5	2,1	4	1,82	9	1,97
Haplothrips kurdjumovi	1	0,4	-	-	1	0,21
Haplothrips minutus	**127**	**53,3**	**107**	**48,85**	**234**	**51,2**
Haplothrips subtilissimus	4	1,68	7	3,2	11	2,4
Total	**238**		**219**		**457**	**100**

Table 3. The structural indicators of the thrips populations, in the plum orchard, Stanley variety

14 April, corolla distention	**Σ**	**x**	**ind./ tree**	**s^2**	**STDEV**	**s'**	**mg.d.s. /m^2**	**A%**	**C%**	**p_i**	**log p_i**	**p_i log p_i**
Thrips validus	1	0.1	1	0.1	0.3	0	0.1	20.00	10	0.2	-0.699	-0.1398
Haplothrips minutus	4	0.4	4	0.27	0.5	0.1	0.4	80.00	30	0.8	-0.0969	-0.0775
Σ	5	**0.5**	**5**	0..9	1.3	0.3	**0.5**	100.00		1.00	-0.7959	-0.2173
18 April, in bloom		H(S)	=0.72				Hmax	=2			E%	=**31**
Frankliniella intonsa	3	0,3	3	0,5	0,7	0,07	0,30	5,00	20	0,05	-1,041	-0,095
Thrips validus	18	1,8	18	1,7	1,3	0,13	1,80	30,00	80	0,30	-0,263	-0,144
Thrips fuscipennis	4	0,4	4	0,5	0,7	0,07	0,40	6,67	30	0,07	-1,176	-0,078
Haplothrips minutus	33	3,3	33	9,3	3,1	0,31	3,30	55,00	90	0,55	-0,260	-0,143
Haplothrips subtilissimus	2	0,2	2	0,2	0,4	0,04	0,20	3,33	20	0,03	-1,477	-0,049
Σ	60	**6,0**	**57**	13,1	3,6	0,36	**5,70**	100,00		1,00	-3,176	-0,414
23 April, falling of first petals		H(S)	=1.38				Hmax	=3			E%	=**49**
Aeolothrips intermedius	2	0,2	2	0,4	0,6	0,06	0,20	2,27	10	0,02	-1,643	-0,037
Frankliniella intonsa	7	0,7	7	0,7	0,8	0,08	0,70	7,95	50	0,08	-1,099	-0,087
Taeniothrips inconsequens	2	0,2	2	0,2	0,4	0,04	0,20	2,27	20	0,02	-1,643	-0,037
Thrips fuscipennis	5	0,5	5	0,5	0,7	0,07	0,50	5,68	40	0,06	-1,246	-0,071
Thrips validus	27	2,7	27	5,1	2,3	0,23	2,70	30,68	80	0,31	-0,513	-0,157
Haplothrips minutus	44	4,4	44	13,8	3,7	0,37	4,40	50,00	90	0,50	-0,301	-0,151
Haplothrips kurdjumovi	1	0,1	1	0,1	0,3	0,03	0,10	1,14	10	0,01	-1,944	-0,022
Σ	88	8,8	**88**	24,4	4,9	0,49	**8,60**	100,00		1,00	-6,747	-0,526
28 April, falling of last petals		H(S)	=1.75				Hmax	=3			E%	=**62**
Taeniothrips inconsequens	3	0,3	3	0,5	0,7	0,07	0,30	5,66	10	0,06	-1,247	-0,071
Thrips fuscipennis	7	0,7	7	1,1	1,1	0,11	0,70	13,21	40	0,13	-0,879	-0,116
Thrips tabaci	1	0,1	1	0,1	0,3	0,03	0,10	1,89	10	0,02	-1,724	-0,033
Thrips validus	15	1,5	15	4,7	2,2	0,22	1,50	28,30	30	0,28	-0,548	-0,155
Haplothrips minutus	25	2,5	25	12,5	3,5	0,35	2,50	47,17	50	0,47	-0,326	-0,154
Haplothrips subtilissimus	2	0,2	2	0,2	0,4	0,04	0,20	3,77	20	0,04	-1,423	-0,054
Σ	53	**5,3**	**53**	15,8	4,0	0,40	**5,30**	100,00		1,00	-6,148	-0,582
		H(S)	=2				Hmax	=3			E%	=**64**
3 May, fruit formation	Σ	x	ind./ tree	s^2	s	s'	**mg.d.s. /m^2**	A%	C%	p_i	log p_i	p_i log p_i
Aeolothrips intermedius	1	0,1	1	0,1	0,3	0	0,1	4,55	10	0,05	-1,3424	-0,061
Thrips tabaci	1	0,1	1	0,1	0,3	0	0,1	4,55	10	0,05	-1,3424	-0,061
Thrips validus	6	0,6	6	1,16	1,1	0,1	0,6	27,27	30	0,27	-0,5643	-0,1539
Haplothrips minutus	14	1,4	14	4,27	2,1	0,2	1,4	63,64	40	0,64	-0,1963	-0,1249
Σ	22	**2,2**	**22**	15,8	4	0,4	**2,2**	100,00		1,00	-3,4454	-0,4008
11 May, fruit formation		H(S)	=1.33				Hmax	=2			E%	=**57**
Thrips tabaci	1	0,1	1	0,1	0,3	0	0,1	8,33	10	0,08	-1,0792	-0,0899
Thrips validus	4	0,4	4	0,93	1	0,1	0,4	33,33	20	0,33	-0,4771	-0,159
Haplothrips minutus	7	0,7	7	1,57	1,3	0,1	0,7	58,33	30	0,58	-0,2341	-0,1365
Σ	12	**1,2**	**12**	10,9	3,3	0,3	**1,2**	100,00		1,00	-1,7904	-0,3855
		H(S)	=1.28				Hmax	=2			E%	=**55**

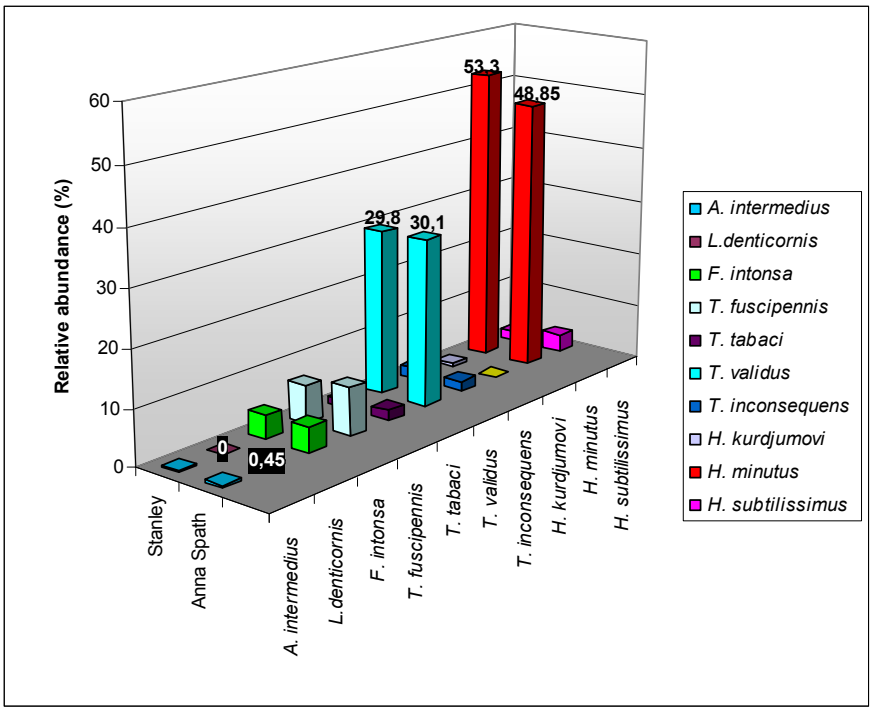

Figure 1. Relative abundance of thrips species to plum varieties

b. Structural indicators of thrips populations of Anna Späth variety

9 thrips species were identified to Anna Spath variety: *Aeolothrips intermedius*, *Limothrips denticornis, Frankliniella intonsa, Taeniothrips inconsequens, Thrips fuscipennis, Thrips validus, Thrips tabaci, Haplothrips minutus, Haplothrips subtilissimus*. Most of them are common with Stanley variety.

The basic nucleus of the Thysanoptera association is made up of the species *Haplothrips minutus* and *Thrips validus. H. minutus* has the highest values of structural parameters, too (Fig. 1, Table 4). The polyphagous floricolous *Thrips validus* has high values of structural parameters, following the *H. minutus*, both species with high frequencies in samples. *Limothrips denticornis* is a typical graminicolous species, only accidentally getting on the plum.

Table 4. The structural indicators of the thrips populations, in the plum orchard, Anna Späth variety

18 April, corolla distention	Σ	x	ind./tree	s^2	**STDEV**	s'	**mg.d.s. /m²**	A%	C%	p_i	log p_i	p_i log p_i
Thrips tabaci	1	0,1	1	0,1	0,3	0	0,1	14,29	10	0,14	-0,8451	-0,1207
Haplothrips minutus	6	0,6	6	0,71	0,8	0,1	0,6	85,71	40	0,86	-0,0669	-0,0574
Σ	7	**0,7**	**7**	10,8	3,3	0,3	**0,7**	100,00		1,00	-0,912	-0,1781
23 April, in bloom		H(S)	=0,.9				Hmax	=2			E%	=**25**
Limothrips denticornis	1	0,1	1	0,1	0,3	0,03	0,10	1,32	10	0,01	-1,881	-0,025
Frankliniella intonsa	4	0,4	4	0,3	0,5	0,05	0,40	5,26	40	0,05	-1,279	-0,067
Thrips fuscipennis	7	0,7	7	1,1	1,1	0,11	0,70	9,21	40	0,09	-1,036	-0,095
Thrips validus	26	2,6	26	4,9	2,2	0,22	2,60	34,21	80	0,34	-0,466	-0,159
Haplothrips minutus	32	3,2	32	6,6	2,6	0,26	3,20	42,11	80	0,42		-0,158
Haplothrips subtilissimus	6	0,6	6	1,2	1,1	0,11	0,60	7,89	30	0,08	-1,103	-0,087
Σ	76	**7,6**	**76**	18,3	4,3	0,43	**7,60**	100,00		1,00	-3,883	-0,5673
28 April, falling of first petals		H(S)	=1.36				Hmax	=3			E%	=**48**

Frankliniella intonsa	5	0,5	5	0,5	0,7	0,07	0,50	7,58	40	0,08	-1,121	-0,085
Taeniothrips inconsequens	2	0,2	2	0,2	0,4	0,04	0,20	3,03	20	0,03	-1,519	-0,046
Thrips fuscipennis	5	0,5	5	0,5	0,7	0,07	0,50	7,58	40	0,08	-1,121	-0,085
Thrips validus	17	1,7	17	2,9	1,7	0,17	1,70	25,76	70	0,26	-0,589	-0,152
Thrips tabaci	1	0,1	1	0,1	0,3	0,03	0,10	1,52	10	0,02	-1,820	-0,028
Haplothrips minutus	35	3,5	35	8,7	3,0	0,30	3,50	53,03	90	0,53	-0,275	-0,146
Haplothrips subtilissimus	1	0,1	1	0,1	0,3	0,03	0,10	1,52	10	0,02	-1,820	-0,028
Σ	66	6,6	**66**	5,6	2,4	0,24	**6,60**	100,00		1,00	-8,263	-0,569
3 May, falling of last petals		H(S)	=1.80				Hmax	=3			E%	=**64**
Aeolothrips intermedius	1	0,1	1	0,1	0,3	0,03	0,10	2,08	10	0,02	-1,681	-0,035
Taeniothrips inconsequens	2	0,2	2	0,2	0,4	0,04	0,20	4,17	20	0,04	-1,380	-0,058
Thrips fuscipennis	7	0,7	7	1,1	1,1	0,11	0,70	14,58	40	0,15	-0,836	-0,122
Thrips validus	15	1,5	15	4,7	2,2	0,22	1,50	31,25	50	0,31	-0,505	-0,158
Haplothrips minutus	23	2,3	23	8,7	2,9	0,29	2,30	47,92	60	0,48	-0,320	-0,153
Σ	48	**4,8**	**48**	15,3	3,9	0,39	**4,80**	100,00		1,00	-4,722	-0,525
8 May, fruit formation		H(S)	=2				Hmax	=3			E%	=**58**
Frankliniella intonsa	1	0,1	1	0,1	0,3	0	0,1	5,88	10	0,06	-1,2304	-0,0724
Thrips tabaci	2	0,2	2	0,18	0,4	0	0,2	11,76	20	0,12	-0,9294	-0,1093
Thrips validus	6	0,6	6	0,71	0,8	0,1	0,6	35,29	40	0,35	-0,4523	-0,1596
Haplothrips minutus	8	0,8	8	1,73	1,3	0,1	0,8	47,06	30	0,47	-0,3274	-0,1541
Σ	17	**1,7**	**17**	10,8	3,3	0,3	**1,7**	100,00		1,00	-2,9395	-0,4954
11 May, fruit formation		H(S)	=1.65				Hmax	=2			E%	=**71**
Thrips validus	2	0,2	2	0,18	0,4	0	0,2	40,00	10	0,4	-0,3979	-0,1592
Haplothrips minutus	3	0,3	3	0,23	0,5	0	0,3	60,00	30	0,6	-0,2218	-0,1331
Σ	5	0,5	5	11,6	3,4	0,3	0,5	100,00		1,00	-0,6198	-0,2923
		H(S)	=0,.7				Hmax	=2			E%	=**42**

The low values of the diversity index Shannon-Weaver H(S) are correlated with reduced values of equitability (Table 4). The number of individuals of *Haplothrips minutus* and *Thrips validus* is responsible for the numeric disproportion in the samples, in most of the phenophases.

c. The frequency of attack [F (%)]

At "in bloom" phenophase it was collected 100 flowers of each variety and observed the attack on petals. The data obtained are presented in Table 5.

Table 5. The frequency of attack on plum varieties

Variety	Number of collected petals	Number of damaging petals	Frequency of attack (%)
Stanley	100	7	7
Anna Späth	100	4	4

According to Lewis (1973), the females of many species of thrips lay eggs in most in the floral bracts. Consequently, possibility of affect flower ovary is low. The damaging petals are major to the ornamental plants, because their commercial value is reduced. In our study, the values recorded are small, so that thrips species cause insignificant damage in plum orchards.

4. CONCLUSIONS

In the plum varieties studied in the orchard of Moraresti-Argeş, the structure of the Thysanoptera fauna is made up of 10 species, grouped along two trophic levels: 8 species – primary consumers, and 2 species – secondary consumers. This fact reveals a poor biodiversity, typical for an agro-ecosystem. All species are polyphagous.

Haplothrips minutus, Haplothrips subtilissimus and *Taeniothrips inconsequens* are arboricolous, while *Thrips fuscipennis* is present both herbaceous and woody essences.
Structural indicators values indicate species *Haplothrips minutus* as characteristic species plum, with the highest values of relative abundance and frequency of the samples.
The Shannon-Weaver diversity index and equitability have low values, a situation which is typical of agro-ecosystems.

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